

TAPPING THE SUN IN THE NEXT MILLENNIUM

An optical lens device concentrates sunlight onto solar cells, providing cost savings for photovoltaic systems powering spacecraft and homes.



■ SCARLET™ technology (pictured above) concentrates light to the strength of many suns onto a small area of solar cells.

How expensive is it to use solar electricity to power next-generation communications satellites? Even though sunlight is inexhaustible and free, a conventional satellite solar cell array that generates 15 kilowatts (kW)—enough power to heat a small house—can cost as much as \$20 million to build. Furthermore, because of their bulky, rigid designs, these arrays can significantly increase a satellite's launch costs.

ENTECH, Inc. (Keller, TX), has developed an optical lens device, called the line-focus Fresnel lens, that could save millions of dollars in deployment costs for solar-powered spacecraft. The lens reduces the amount of solar cell material needed to produce a given amount of power by a factor of 10. Because considerably less cell area than is required with conventional arrays, tremendous weight and cost savings can be realized. In addition, because of its light concentration effects and ability to use cell material optimized for the focused wavelengths, the lens greatly enhances power efficiencies.

Magnifying glass. Like a magnifying glass, the lens captures, funnels, and concentrates sunlight. Its cylindrical design has a smooth outer surface and an inner surface made of microscopic prisms that shape the light with a much higher efficiency than previous solar concentrator designs. BMDO, which initially funded ENTECH's design concept through an SBIR contract, is funding further research and development on the lens for the Solar Concentrator Array with Refractive Linear Element Technology (SCARLET™) program.

ENTECH and AEC-Able Engineering Company, Inc. (Goleta, CA), have developed two lens designs, SCARLET I and II, for future advanced space power applications. Although the METEOR I launch vehicle carrying SCARLET I failed 45 seconds after its October 1995 launch, another SCARLET array, which has been further enhanced, was chosen for NASA's New Millennium Deep Space 1 (DS1) spacecraft, which was launched in October 1998.

Two SCARLET II solar wing assemblies consisting of 720 ENTECH line-focus Fresnel lenses will power the DS1 spacecraft and its revolutionary ion thrusters. This mission will mark the first time that ion propulsion, rather than chemical-based propulsion, is being used as a primary means to propel a spacecraft. Once proven to work, solar-powered ion thrusters will enable next-generation spacecraft to travel 10 times faster than those using chemical propellant systems.

Buying more sun for the dollar. SCARLET II solar arrays can provide spacecraft makers with a tremendous cost savings. "In a recent study, AEC-Able found that SCARLET II technology could save an estimated \$9 million to \$13 million when it is used to replace a conventional 15 kW gallium arsenide on germanium array," says Mark O'Neill, ENTECH's president. "That's a savings of \$600 to \$900 per watt of array power, which enables companies to buy a lot more sun for their dollar." ENTECH has an exclusive agreement with AEC-Able for the space-based concentrator. The team hopes to capture a large portion of the communications satellite market, and by using SCARLET II technology, hopes to significantly reduce solar array costs. A more compact third-generation SCARLET array is currently being developed.

In addition, ENTECH is pursuing terrestrial applications for its solar concentrator. For example, its SolarRow product is designed to provide renewable electrical power with zero emissions for utility-scale applications. In late 1996, ENTECH was selected by a team led by Nevada Power Corporation to provide large-scale solar power plants for the Solar Enterprise Zone (SEZ) in Nevada. The SEZ project could result in 20-megawatt capacity of ENTECH equipment installed and operating in the Nevada desert within the next five years. In the Southwest, two electric utilities have recently built 100 kW power plants using ENTECH SolarRows.

The company's SUNLINE™ stand-alone power units can supply power for small or remote electricity demands. These units can offer a clean, quiet, non-polluting, renewable power source for a wide range of applications, including lights, water pumps, small villages, remotely located homes, and water purification systems.

■ For more information, contact Mark O'Neill via telephone at (817) 379-0100 or via E-mail at moneill@startext.net. You can also visit ENTECH's Web site at <http://www.entsolar.com>.



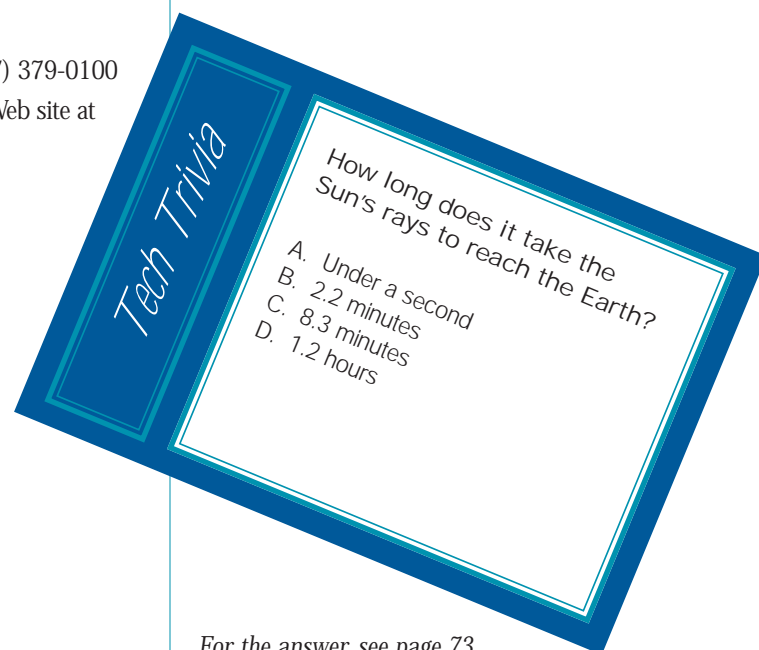
What Does It Mean to You?

Fresnel lenses increase solar cell efficiency and reduce array costs, bringing solar electricity one step closer to reality as a cheap, pollution-free power source for homes and businesses.



What Does It Mean to Our Nation?

By enabling cheaper, more powerful spacecraft, solar concentrators will help facilitate the launch of communications satellites and U.S. Government-sponsored exploratory spacecraft.



For the answer, see page 73.